UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/811,946	03/30/2004	Young Wook Choi	955-1003	3107

38209 7590 12/03/2007

STANZIONE & KIM, LLP
919 18TH STREET, N.W.
SUITE 440
WASHINGTON, DC 20006

EXAMINER	
BAND, MICHAEL A	
ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
12/03/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/811,946	CHOI ET AL.	
	Examiner	Art Unit	
	Michael Band	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 September 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-7 and 9-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 3-7, and 9-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1, 3-7, and 9-17 rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claim 1 claims to separate an electric voltage and electric current. Claim 7 claims to apply an electric voltage, followed by applying an electric current. This is considered either too ambiguous for the Examiner to understand or not possible. The well known equation of:

$$\text{Voltage (V)} = \text{Current (A)} \times \text{Resistance } (\Omega)$$

states that electric voltage and electric current are dependant upon one another and cannot be separated out to apply at distinct times. Thus as an electric voltage is applied to a target, an electric current also is applied to the same target simultaneously. In addition, it is also well known that power is related to voltage and current as evidenced by:

$$\text{Power (w)} = \text{Voltage (V)} \times \text{Current (A)}$$

3. Claims 1, 3-6 and 16 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter

which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicant claims "applying an electric current to the magnesium target by the power control part to increase power on the magnesium target when the applied voltage on the magnesium target stops increasing *in response to an increase in the applied voltage*". There is no support for this in the specification.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 7, 9-15 and 17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

6. Applicant claims in claim 7 "a power control part to apply a voltage and an electric current the magnesium target, *the power control part applying the voltage and subsequently applying the current when the voltage on the magnesium target stops increasing when the applied voltage increases*". Examiner is unclear as to how a current will be applied after the voltage stops to increase said voltage.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims 1, 3-4, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hagg et al (US Patent No. 6,337,001) in view of Lanford et al (US Patent No. 5,622,608).

With respect to claim 1, Haag et al discloses a sputtering apparatus capable of applying an increasing voltage to at least one target (fig. 12, [c]) through a magnetic field. In addition fig. 12, [c] further depicts power (P) increasing as noted by the watts (W) sign. A watt is well known to be the result of voltage times current. Haag et al further discloses that a DC generator is configured for the targets (col. 3, line 22), with the generator outputting "a pulsed DC signal" (col. 3, line 25). Fig. 1 depicts a selector switch (i.e. power control part) [20] to apply a DC potential or a DC potential with a superimposed AC potential (col. 4, lines 41-48). Electrical voltage has been shown to be directly correlated to electrical current. Since the voltage is increasing, the current must increase as well. This process is suitable for sputter coatings, "in particular for depositing MgO" (col. 3, line 30). However Haag et al is limited in that while an increasing voltage on the target is depicted, it is not specified if the voltage is increasing during deposition.

Lanford et al teaches a process of making oxidation resistant copper layers by forming a magnesium oxide layer at the surface of the copper layer (abstract). Lanford et al also teaches sputter deposition using distinct targets of copper and magnesium (col. 2, lines 32-36). In addition, Lanford et al states supplying different (i.e. increasing/decreasing) power levels to the second metal (i.e. magnesium) target during deposition (col. 2, lines 32-41; col. 6, lines 15-18). Lanford et al cites the advantage of increasing the power level during sputtering as increasing the deposition rate (cool. 6, lines 10-13).

It would have been obvious to one of ordinary skill in the art to increase the target power during sputtering taught by Lanford et al for the process of Haag et al to gain the advantage of maximizing the deposition rate.

With respect to claim 4, modified Haag et al further discloses fig. 12, [c] depicting an increasing voltage until the power supplied has saturated the target. The amount of current will increase proportionally with an increase in voltage. Therefore when the voltage stops increasing upon target saturation, the current stops increasing simultaneously.

With respect to claim 16, modified Haag et al further discloses that a DC generator is configured for the targets (col. 3, line 22), with the generator outputting "a pulsed DC signal" (col. 3, line 25). It is well known that a pulsed DC signal, as described by Haag et al, expectantly gives a negative square wave, as evidenced by Chiang et al (USPGPub 2001/0050220; fig. 2; p. 2, para 0021).

With respect to claim 3, modified Haag et al further discloses figure 12, part "c" depicting the voltage increasing until the power has saturated the target, at which the

voltage levels off at approximately 310 volts. The voltage starts at approximately 250 volts.

It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by prior art" a prima facie case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990).

10. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Haag et al (US Patent No 6,337,001) and Lanford et al (US Patent No. 5,622,608) as applied to claim 4 above, and further in view of Chiang et al (USPGPub No. 2001/0050220).

With respect to claim 5, the reference is cited as discussed for claim 4. However modified Haag et al is limited in that while it is disclosed that there is a pulsed DC power source (col. 3, line 25) that must output a frequency, a particular value is not specified.

Chiang et al teaches an apparatus for physical vapor deposition via magnetron sputtering utilizing a "modulated direct current power supply" (p. 2, para 21) provided to the target for metal plasma deposition to substrates. The particular arrangement of the power supply can also encompass pulse generators, making a pulsed DC signal (p. 2, para 21) with the frequency between 1 kHz and 200 kHz (p. 3, para 30).

It would have been obvious to one of ordinary skill in the art to use the frequency of Chiang et al as the frequency in Haag et al since Haag et al fails to disclose a specific frequency, Chiang et al teaches frequencies known to be functional in a sputtering target magnetron assembly and one of ordinary skill would have a reasonable expectation of success in using such frequencies.

It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

With respect to claim 6, the reference is cited as discussed for claim 4. However modified Haag et al is limited in that while it is disclosed that there is a pulsed DC power source (col. 3, line 25) that must have a duty cycle, a particular value is not specified.

Chiang et al teaches an apparatus for physical vapor deposition via magnetron sputtering utilizing a "modulated direct current power supply" (p. 2, para 21) provided to the target for metal plasma deposition to substrates. The particular arrangement of the power supply can also encompass pulse generators, making a pulsed DC signal (p. 2, para 21) with the duty cycle (i.e. duty ratio) between about 50% and about 90% (p. 3, para 30).

It would have been obvious to one of ordinary skill in the art to use the duty cycle of Chiang ' 220 as the duty cycle in Haag et al since Haag et al fails to disclose a specific duty cycle and one of ordinary skill would have a reasonable expectation of success in using such a duty cycle.

It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

11. Claims 7, 10-13, 15, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Haag et al (US Patent No 6,337,001) in view of Lanford et al (US Patent No. 5,622,608) and Stollenwerk et al (US Patent No. 6,623,607).

With respect to claim 7, Haag et al discloses a sputtering apparatus capable of applying an increasing voltage to at least one target (fig. 12, [c]) through a magnetic field. In addition fig. 12, [c] further depicts power (P) increasing as noted by the watts (W) sign. A watt is well known to be the result of voltage times current. Haag et al further discloses that a DC generator is configured for the targets (col. 3, line 22), with the generator outputting "a pulsed DC signal" (col. 3, line 25). Fig. 1 depicts a selector switch (i.e. power control part) [20] to apply a DC potential or a DC potential with a superimposed AC potential (col. 4, lines 41-48). Electrical voltage has been shown to be directly correlated to electrical current. Since the voltage is increasing, the current must increase as well. This process is suitable for sputter coatings, "in particular for depositing MgO" (col. 3, line 30). Fig. 9 further depicts a substrate holder (i.e. substrate control part) [32], flow control parts attached to gas tanks [42], [43], and a vacuum control part seen on the left side of the figure to maintain a vacuum chamber (col. 4, lines 41-48). However Haag et al is limited in that while an increasing voltage on the target is depicted, it is not specified if the voltage is increasing during deposition.

Lanford et al teaches a process of making oxidation resistant copper layers by forming a magnesium oxide layer at the surface of the copper layer (abstract). Lanford et al also teaches sputter deposition using distinct targets of copper and magnesium (col. 2, lines 32-36). In addition, Lanford et al states supplying different (i.e. increasing/decreasing) power levels to the second metal (i.e. magnesium) target during deposition (col. 2, lines 32-41; col. 6, lines 15-18). Lanford et al cites the advantage of increasing the power level during sputtering as increasing the deposition rate (cool. 6, lines 10-13).

It would have been obvious to one of ordinary skill in the art to increase the target power during sputtering taught by Lanford et al for the process of Haag et al to gain the advantage of maximizing the deposition rate.

However, Haag et al is further limited in that Haag et al does not include a heater control part.

Stollenwerk et al also teaches a sputtering apparatus with a heating element (fig. 1, [19]) and a heater control part (fig. 1, [19a]) to control the heating or cooling the substrate during the process, leading to better coating of MgO film (fig. 10).

It would have been obvious to one of ordinary skill in the art to use the heater taught in Stollenwerk et al with the apparatus in Haag et al in order to gain the advantages of better MgO film coating by controlling the heating and cooling of the substrate well known in the art and that one of ordinary skill would have a reasonable expectation of success in making the modification.

With respect to claim 10, Stollenwerk et al further discloses an apparatus using both oxygen and argon in a magnetron sputtering process (fig. 1, [9], [13]). The argon passes through the slit (fig. 1, [3]) and over the magnesium targets (fig. 1, [1a], [1b]). The oxygen is in contact with the magnesium target near the targets end point, just before the substrate.

With respect to claim 11, modified Haag et al further discloses an apparatus with flow control part encompassing an oxygen flow regulator (fig. 9, [43]), argon flow regulator (fig. 9, [42]), cut-off valves seen above parts [42] and [43] (fig. 9), and a gas supply line (fig. 9). Although fig. 9 does not depict the oxygen being supplied to the

magnesium target, Haag et al does state "sputtering from metallic Mg targets and reaction with the gas G_r containing O_2" (col. 6, lines 16-17).

With respect to claim 12, Haag et al further discloses the substrate control part using a substrate-supporting member (fig. 9, [32]) that holds the substrate in place for the sputtering process. However Haag et al is limited in that Haag et al does not mention the substrate-supporting member capable of moving.

Stollenwerk et al further teaches a substrate-supporting member capable of moving the substrate (fig. 1, [15]; col. 4, lines 19-20) to increase exploitation percentage of target and decrease in wasted materials.

It would have been obvious to one of ordinary skill in the art to use the substrate support and conveyor taught in Stollenwerk et al as the substrate support in Haag et al in order to gain the advantages of increased target exploitation and better substrate coating and one of ordinary skill would have a reasonable expectation of success in making the modification.

With respect to claim 13, Haag et al further discloses a vacuum pump and vacuum gage depicted in fig. 9, near the top left of the figure (col. 4, lines 41-42). The pressure is maintained at 0.6 mbar (col.7, line 13). While Haag et al does not explicitly disclose a pressure regulator present, one of ordinary skill in the art would know that a pressure regulator must exist to compensate for the gas inflow and outflow and to maintain a 0.6 mbar pressurized atmosphere.

With respect to claim 15, Stollenwerk et al further discloses a heater powered by a heat source (fig. 1, [19], [19a]). Stollenwerk et al also states that "the targets are operated by DC generators, whereby also AC or DC with superimposed AC or pulsating

DC operation" (col. 4, lines 4-7). However Stollenwerk et al states that this power source supplies the targets. Nothing is stated about the powering of the heater, yet there must be some power source that supplies the heater, whether that be a dependant source (i.e. power source for targets) or independent source (i.e. separate power source from target).

It has been held that obviousness may sometimes be based on the common knowledge of persons skilled in the art without relying on a specific suggestion in a particular reference. *In re Bozek*, 416 F.2d 1385, 1390, 163 USPQ 545, 549 (CCPA 1969).

With respect to claim 17, Haag et al further discloses that a DC generator is configured for the targets (col. 3, line 22), with the generator outputting "a pulsed DC signal" (col. 3, line 25). It is well known that a pulsed DC signal, as described by Haag et al, expectantly gives a negative square wave, as evidenced by Chiang et al (USPGPub 2001/0050220; fig. 2; p. 2, para 0021).

12. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Haag et al (US Patent No 6,337,001), Lanford et al (US Patent No. 5,622,608), and Stollenwerk et al (US Patent No. 6,623,607) as applied to claim 7 above, and further in view of Chiang et al (USPGPub No. 2001/0050220).

With respect to claim 9, the references are cited as discussed for claim 7. Modified Haag et al further teaches a sputtering apparatus with a voltage range approximately between 250 volts and 310 volts (fig. 12, [c]). However modified Haag et al is limited in that while there must be an amp value associated with voltage, Haag et al does not disclose a specific amp value.

Stollenwerk et al further teaches a target in a sputtering apparatus using a discharge voltage (i.e. output voltage) of 310 volts (col. 5, lines 34-35) and a discharge current (i.e. output current) of 27 amps (col. 5, line 37) from the target.

It would have been obvious to one of ordinary skill in the art to use the amp value taught in Stollenwerk et al as the amp value in Haag et al since Haag et al fails to disclose a specific amp value and the amp value of Stollenwerk et al is a value known to be operable in a device such as Haag et al using the same voltage.

However modified Haag et al is limited in that it does not disclose a specific frequency or duty ratio associated with the power output.

Chiang et al teaches an apparatus for physical vapor deposition via magnetron sputtering utilizing a pulsed DC power source (i.e. power control) operating between a voltage supplied to the target between about 100 volts and about 300 volts (p. 3, para 28). Chiang et al also teaches the power source operating at a frequency range of 1 kHz to 200 kHz and about 50% to about 90% duty cycle (i.e. duty ratio).

It would have been obvious to one of ordinary skill in the art to use the frequency and duty cycle of Chiang et al as the frequency and duty ratio in modified Haag et al since modified Haag et al fails to disclose a specific frequency and duty cycle associated with the power output and the frequency and duty cycle ranges of Chiang et al are values known to be operable in a device such as Haag et al using the same voltage.

13. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Haag et al (US Patent No 6,337,001), Lanford et al (US Patent No. 5,622,608), and Stollenwerk

et al (US Patent No. 6,623,607) as applied to claim 7 above, and further in view of Sakakibara et al (US Patent No. 5,900,391).

With respect to claim 14, the references are cited as discussed for claim 7. Stollenwerk et al of modified Haag et al further discloses the temperature of a process chamber at which the substrate is coated, either at 180°C (col. 6, line 13-14) or 200°C (col. 6, lines 46-47). Stollenwerk et al also depicts the heater a certain adjustable distance from the substrate. However Stollenwerk et al is limited in that it discloses that there is a heater above the substrate a certain adjustable distance (fig. 1, [19a]; col.5, lines 26-30) but does not teach a specific distance or range of distances the heater is from the substrate.

Sakakibara '391 teaches a sputtering apparatus contained inside a vacuum chamber. The heater (fig. 1, [13]) is separated from a substrate (fig. 1, [2]), with the distance between the heater and the substrate being from 1 mm to 2 mm (col. 3, lines 43-47) to increase the temperature of the substrate, thereby imparting increased crystalline quality and decreased surface resistance forming a better superconducting MgO film (col. 1, lines 45-55).

It would have been obvious to one of ordinary skill in the art to use the distance specified by Sakakibara '391 as the adjustable distance for the heater of Stollenwerk et al as added to Haag et al in order to impart increased crystalline quality and decreased surface resistance, thereby forming a superior superconducting MgO film.

Response to Arguments

Objections

14. The minor informality has been removed and no new matter has been added. Therefore the objection is withdrawn.

102 Rejections

15. Applicant's arguments with respect to claims 1, 3-7, and 9-17 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Band whose telephone number is (571) 272-9815. The examiner can normally be reached on Mon-Fri, 8am-4pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

18. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MAB

MB

ALEXA D. NECKEL
SUPERVISORY PATENT EXAMINER